

CLAIMS

1. A photo-detecting apparatus comprising:

5 a pixel section including a photodiode for generating electric charge of the amount corresponding to intensity of incident light, an amplifying transistor for outputting a voltage value corresponding to the amount of the electric charge accumulated in a parasitic capacitance section formed at its gate terminal, a transmitting transistor for transmitting the electric charge generated at said photodiode to the gate terminal of said amplifying transistor, a discharging transistor for
10 initializing the electric charge of said parasitic capacitance section, and a selecting transistor for outputting selectively the voltage value outputted from said amplifying transistor;

15 a first pixel data readout section for reading out the voltage value outputted from said selecting transistor of said pixel section and outputting a first voltage value corresponding to this voltage value;

20 a connection switching section, having a first terminal connected to said discharging transistor of said pixel section, a second terminal for inputting a bias potential for initializing the electric charge of the gate terminal of the amplifying transistor in said pixel section, and a third terminal, for making an electrical connection between said first terminal and said second terminal, or between said first terminal and said third terminal; and

25 a second pixel data readout section, of which the input terminal is connected to said third terminal of said connection switching section, and which includes a capacitive element having a larger capacitance value than that of said parasitic capacitance section, for accumulating the

electric charge flown from said third terminal of said connection switching section to said input terminal in said capacitive element, and outputting a second voltage value corresponding to the amount of the accumulated electric charge.

5 2. A photo-detecting apparatus comprising:

 a pixel section including: a photodiode for generating an electric charge of the amount corresponding to intensity of incident light; a transmitting transistor having a gate terminal for inputting a transmission control signal, a first terminal connected to said photodiode, and a second
10 terminal; a discharging transistor having a gate terminal for inputting a discharge control signal, a first terminal connected to the second terminal of said transmitting transistor, and a second terminal; an amplifying transistor having a gate terminal connected to the second terminal of said transmitting transistor and the first terminal of said discharging transistor
15 respectively, a first terminal set to a given potential, and a second terminal; and a selecting transistor having a gate terminal for inputting a selection control signal, a first terminal connected to the second terminal of said amplifying transistor, and a second terminal;

 a first pixel data readout section having an input terminal
20 connected to the second terminal of said selecting transistor in said pixel section;

 a connection switching section, having a first terminal connected to the second terminal of said discharging transistor in said pixel section, a second terminal set to a given bias potential, and a third terminal, for
25 making an electrical connection at any one of between said first terminal and said second terminal, and between said first terminal and said third

terminal; and

a second pixel data readout section including an input terminal connected to the third terminal of said connection switching section, and a capacitive element for accumulating an electric charge flown in by way of the input terminal.

3. A photo-detecting apparatus according to claim 1, wherein the capacitance value of said capacitive element included in said second pixel data readout section is 2^K times as large as that of said parasitic capacitance section, where K is an integer of 1 or more.

4. A photo-detecting apparatus according to claim 1 or 2, wherein said photodiode included in said pixel section is provided on a first semiconductor region of a first conduction-type, a second semiconductor region of a second conduction-type provided on said first semiconductor region, and establishing a pn junction between the first and second semiconductor regions, and a third semiconductor region of the first conduction-type provided on said second semiconductor region, and establishing the pn junction between the third and second semiconductor regions.

5. A photo-detecting apparatus according to claim 1 or 2, wherein said pixel section further includes an interrupting transistor that is arranged between said photodiode and said transmitting transistor, and that has a gate terminal set to a given potential, a first terminal connected to said photodiode, and a second terminal connected to the first terminal of said transmitting transistor.

6. A photo-detecting apparatus according to claim 1 or 2, further comprising a plurality of pixel sections each having the same

structure as that of said pixel section, and constructing a two-dimensional arrangement with the pixel section.

7. A photo-detecting apparatus according to claim 6, wherein said second pixel data readout section has a plurality of capacitive elements provided corresponding to each column of the two-dimensionally arranged pixel section as said capacitive element.

8. A photo-detecting apparatus according to claim 6, wherein during the period when said first pixel data readout section processes a voltage value outputted from a group of pixel sections belonging to one row among said pixel sections two-dimensionally arranged, said second pixel data readout section processes the electric charge outputted from the group of pixel sections belonging to said row.

9. A photo-detecting apparatus according to claim 6, wherein during the period when said first pixel data readout section processes a voltage value outputted from a group of pixel sections belonging to one row among said pixel sections two-dimensionally arranged, said second pixel data readout section processes the electric charge outputted from the group of pixel sections belonging to another row.

10. A photo-detecting apparatus according to claim 1 or 2, further comprising an A/D converting section for outputting a first digital value corresponding to the first voltage value by A/D converting the first voltage value outputted from said first pixel data readout section, and for outputting a second digital value corresponding to the second voltage value by A/D converting the second voltage value outputted from said second pixel data readout section.

11. A photo-detecting apparatus according to claim 10, further

comprising a selecting output section for inputting a first digital value and a second digital value outputted from said A/D converting section, and for outputting either of said first digital value and said second digital value, based on a result where any one of said first voltage value, said second voltage value, said first digital value and said second digital value is compared in magnitude to a reference value.

12. A photo-detecting apparatus according to claim 1 or 2, further comprising an A/D converting section for inputting a first voltage value outputted from said first pixel data readout section and a second voltage value outputted from said second pixel data readout section, and for outputting either of said first voltage value and said second voltage value, based on a result where either of said first voltage value and said second voltage value is compared in magnitude to a reference value.

13. A photo-detecting apparatus according to claim 12, further comprising an A/D converting section for outputting a digital value corresponding to the voltage value by A/D converting the voltage value outputted from said selecting output section.

14. A photo-detecting apparatus according to claim 1 or 2, wherein said second pixel data readout section includes a logarithmic compressing circuit, arranged in parallel to said capacitive element, for outputting a third voltage value corresponding to a logarithmic value of the amount of in-flow electric charge from said third end of said connection switching section.

15. A photo-detecting apparatus according to claim 14, further comprising an A/D converting section for outputting a first digital value corresponding to the first voltage value by A/D converting the first

voltage value outputted from said first pixel data readout section, and for outputting a second digital value corresponding to the second voltage value and a third digital value corresponding to the third voltage value by A/D converting the second voltage value and third voltage value outputted from said second pixel data readout section.

16. A photo-detecting apparatus according to claim 15, further comprising a selecting output section for inputting a first digital value, a second digital value, and a third digital value outputted from said A/D converting section, and for outputting any one of said first digital value, said second digital value, and said third digital value, based on a result where any one of said first voltage value, said second voltage value, said third voltage value, said first digital value, said second digital value, and said third digital value is compared in magnitude to a reference value.

17. A photo-detecting apparatus according to claim 14, further comprising a selecting output section for inputting a first digital value outputted from said first pixel data readout section, and a second voltage value and a third voltage value outputted from said second pixel data readout section, and for outputting any one of said first voltage value, said second voltage value, and said third voltage value, based on a result where any one of said first voltage value, said second voltage value, and said third voltage value is compared in magnitude to a reference value.

18. A photo-detecting apparatus according to claim 17, further comprising an A/D converting section for outputting a digital value corresponding to the voltage value by A/D converting the voltage value outputted from said selecting output section.